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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Tomantschger

:
: Group Art Unit: 1742

Serial No.: 09/579,531

: Examiner: S. Ip

Filed: May 26, 2000

For: Perforated Current Collectors for Storage Batteries and Electrochemical
Cells, Having Improved Resistance to Corrosion

RESPONSE

Commissioner for Patents
P.O. Box 1450
Alexandria, VA. 22202-3514

13/12/03
05/12/03

Sir:

This is in response to the Office Action dated February 12, 2003, the period for response to which is set to expire on May 12, 2003.

The examiner has rejected claims 20-35 under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. In rejecting the claims the examiner urges that the recited limitation "up to 20 minutes" in the last line of claim 20 is not supported by the originally filed specification. Applicant has carefully considered this rejection but it is most respectfully traversed for the reasons discussed below.

The limitation "up to 20 minutes" refers to the period of time in which the previously perforated metal is subjected to a heat-treatment or annealing step. In this regard the originally filed specification states in the sentence bridging pages 5 and 6 that:

The inventors of the present invention have discovered that the mechanical stress and much more limited deformation imposed on a metal strip in the usual application of a perforation process at near-ambient temperature to perforate the strip, when followed by a heat-treatment step below the melting point of the metal or metal alloy of which the strip is composed, for up to 20 minutes, leads to the formation of a recrystallized grain structure and to the increase in special grain boundary populations to greater than 50%, leading to a substantial improvement in the corrosion and growth resistance of the perforated non-consumable electrodes and current collectors which are made.

The examiner apparently believes that the limitation "up to 20 minutes" extends the lower time limit to include "zero minute". Applicant submits that the examiner's interpretation is without any basis for the reasons discussed in the below paragraph and, in any event, the originally filed specification does indeed provide support for the limitation "up to 20 minutes".

Clearly, there is no basis to conclude that the limitation "up to 20 minutes" includes the time of "zero minute" as alleged by the examiner. In this regard applicant submits that all of the claimed limitations must be considered. Claim 20, and all of the claims which depend therefrom, positively recite that the deformed strip **is annealed** prior to pasting by heating . . .". Clearly, the above noted annealing step inherently requires a finite period of time for the heating to take place. Accordingly it is self-

evident that the time of heat treatment referred to by the limitation "for up to 20 minutes" does not include "zero minutes" as alleged by the examiner in view of the positive recitation of an annealing step which requires a finite period of time for the heating to occur. Furthermore, claim 20 also states that "said heat treatment **being performed** at a temperature . . ." which further emphasizes that the heat treatment takes place for a finite period of time in view of the limitation which requires that the heat treatment is "performed".

The examiner has rejected claims 1-3, 6-16, 18-22 and 25-35 under the judicially created doctrine of obviousness-double patenting as being unpatentable over claims 1-6 of Palumbo in view of JP 406267544 (Yasuda et al.). In rejecting the claims the examiner urges that the claims of Palumbo disclose the features including the claimed metallic current collector and cold work and recrystallization annealing. The examiner acknowledges that Palumbo does not disclose the cold work to form a battery grid and pasting. The examiner turns to the secondary reference (Yasuda et al.) for the above-noted deficiencies of Palumbo. In this regard the examiner urges that Yasuda et al. disclose that a lead alloy battery grid/current collector is known to be cold worked to form battery grids by reciprocating dies or the like, pasting the grids and the recrystallization annealing of the pasted grids. The examiner urges that it would be obvious to combine the above-noted teaching of Yasuda et al. to the claims of Palumbo to arrive at the invention of the rejected claims. Applicant has carefully considered this rejection but it is most respectfully traversed for the reasons discussed below.

The claims of Palumbo are directed toward a recrystallized lead or lead alloy positive lead-acid battery electrode which has been processed by the sequential steps of cold working by an amount of approximately 10-80% and an annealing step

sufficient to produce recrystallization so that the percentage of special grain boundaries of the lead or lead alloy comprises at least 50% of the total grain boundaries thereof.

The examiner urges that it would be obvious to modify the claims of Palumbo in accordance with the teaching of Yasuda et al. to arrive at the claimed invention. However, the examiner ignores the fact that the process steps disclosed by Yasuda et al. are for improving adhesion of the paste to the grid. In this regard Yasuda et al. disclose a continuous process of making a Pb-Ca-Sn alloy foil by slab casting, followed by rolling, pasting and then curing at 60°C. The objective of Yasuda et al. which is to improve the adhesive property between the grid and the active material, as well as to improve the service life can only be accomplished by a curing treatment **after pasting**.

Yasuda et al. concern themselves with a rolled strip only, and a heat-treatment following the pasting, not, as in applicant's invention, with a process using the perforation as the deformation treatment on a cast strip or rolled strip, **immediately followed by a heat treatment (prior to pasting)**.

More importantly, Yasuda et al.'s so-called "recrystallization treatment" is actually a curing treatment which is performed **on the pasted grids** at temperatures of 60°C or higher to contract the grid to a specific height. Essentially, Yasuda et al. describe an improved **curing process**, which typically takes place at 60° to 95°C.

Applicant submits that it would not be obvious to modify the claims of Palumbo with the above-noted process steps required by Yasuda et al. since the heating step utilized by Yasuda et al. is for curing the paste and therefore must be conducted after

the pasting operation. In contrast, applicant's invention utilizes a heating step which takes place before the pasting and which accomplishes an entirely different objective which is to accomplish the desired recrystallization to achieve the content of special grain boundary. Furthermore, it is to be noted that the curing process according to Yasuda et al. takes place at 60° to 95°C because it is well known to those skilled in the art that heat treatment to cure the paste needs a temperature below the boiling point of water (100°C) to avoid water loss from the paste during the curing. In this regard it is to be noted that Rao in U.S. patent no. 5,434,025 similarly discloses a curing step for the paste which involves heat treatment. As one skilled in the art would expect, the heat treatment to effect the desired curing of the paste is conducted at temperatures below the boiling point of water and at relative humidities of 95 to 100% since, as noted above, one skilled in the art is well aware of the fact that the heat treatment for curing the paste must be below the boiling point of water to avoid unwanted drying.

In order for an invention to be obvious, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Applicant submits that there would be no motivation to apply the curing heat treatment step required by Yasuda et al. in the claimed process of Palumbo in order to arrive at applicant's invention because the heat treatment step required by Yasuda et al. is for curing the paste. The claims of Palumbo do not utilize a paste and thus there would be no motivation for one skilled in the art to utilize the paste curing method required by Yasuda et al. Furthermore, applicant's claimed invention utilizes the heat treating step to recrystallize the metal prior to pasting. Clearly, there would be no motivation for one skilled in the art to move the heat curing step disclosed by Yasuda et al. to a time which is before the pasting step since, as noted above, Yasuda et al.

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require the heat treating step after pasting to cure the paste.

In view of the above, it is clear that the combined teachings of Yasuda et al. with the claims of Palumbo will not result in the invention of the rejected claims. Thus, the obviousness rejection of claims 1-3, 6-16, 18-22 and 25-35 should be withdrawn.

The examiner has also rejected claims 4-5 and 23-24 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-6 of Palumbo in view of Yasuda et al. and further in view of Rao et al. Applicant submits that this rejection should also be withdrawn for the same reasons discussed above. In particular, one skilled in the art would not be motivated to use the paste curing step required by Yasuda in the claims of Palumbo for the reasons discussed above. Furthermore, the teaching of Rao et al. do not compensate for the above-noted deficiencies of Palumbo and Yasuda et al.

The examiner has rejected claims 1-16 and 18-35 under 35 U.S.C. § 103 as being unpatentable over Abdel-Reihim et al. or Yasuda et al. (JP 406267544) in view of Tilman et al. or Myers and further in view of the teaching of the acknowledged prior art admission on page 2, lines 1-21 of applicant's specification. Applicant has carefully considered this rejection but it is most respectfully traversed for the reasons discussed below.

Applicant will first address the rejection based upon Yasuda et al. in combination with Tilman et al. or Myers and further in view of the above-noted acknowledged prior art admission.

Yasuda et al. disclose a continuous process for making a Pb-Ca-Sn alloy film by slab casting, followed by rolling, pasting and then curing at 60°C. The express objective of Yasuda et al. is to improve adhesion between the grid and the active material (as well as to improve service life), by means of a curing treatment applied **subsequent to pasting**. This is to be contrasted with the present claimed process which uses a perforation step as the deformation treatment for a cast strip or rolled strip, **immediately followed by a recrystallizing heat treatment** (prior to pasting).

The "recrystallization" treatment in the process of Yasuda et al. is actually a curing treatment, performed on the pasted grids at temperatures of 60°C or greater to effect a desired contraction of the grid. As described by Yasuda et al., heat treatment of the pasted plate (which must remain below 100°C to avoid water loss as discussed above) continues for at least one day and is not part of the continuous forming process. Furthermore the heat-treatment parameters applied by Yasuda et al. are substantially different from the heat-treatment required in applicant's invention, especially the claims which require a temperature range of 100-300°C which is substantially above the curing temperatures required by Yasuda et al. and which, as noted above, are below the boiling point of water.

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion or motivation to do so either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. Applicant submits that the prior art does not provide the requisite motivation for modifying the process of Yasuda et al. to arrive at applicant's invention. In this regard it is to be noted that the objective of the primary reference is to improve adhesion of the paste to the grid and

therefore requires that the paste **must be applied to the grid before the heat treatment step** in order for Yasuda et al. to obtain their desired objective. In contrast, the objective of applicant's invention is to provide a heat treatment which leads to a special type of recrystallization whereby the desired percentage of special grain boundary is achieved. As noted previously, heat treatment of the pasted grid is intentionally kept below the boiling point of water which is contrasted with the higher temperatures used in the present invention which lead to the above-noted special type of recrystallization.

The examiner urges that it would be obvious to conduct the annealing or heating step prior to the application of the paste. However, the examiner fails to appreciate that modifying the process of Yasuda et al. so that the heating step preceeds the pasting step **will result in a modification of the primary reference so that it will become unsatisfactory for its intended purpose**. Clearly, if the pasting step is performed after the annealing or heating step as required in applicant's invention, the paste will not be subjected to the heat which Yasuda et al. require for curing the paste and enhancing the adhesion of the paste to the grid. In this regard the examiner's attention is directed toward MPEP §2143.01 which states in part:

If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.

In addition MPEP § 2143.01 further states in part:

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.

A second requirement for establishing a *prima facie* case of obviousness is that there must be a reasonable expectation of success. Applicant submits that there is absolutely no basis for one skilled in the art to expect to achieve the desired special grain boundary content based upon the combined teachings of the prior art since none of the prior art references even remotely disclose or suggest any method whatsoever for achieving the special grain boundary content which applicant achieves in his invention. In fact, none of the prior art references even mention the concept of special grain boundaries.

A third requirement for establishing a *prima facie* case of obviousness requires that the prior art reference (or references when combined) must teach or suggest all of the claim limitations. Applicant submits that a proper combination of the references does not disclose or suggest all of the limitations required by the rejected claims for the reasons discussed below.

The examiner urges that it would be obvious to utilize the recrystallization conditions taught by Tilman et al. and Myers in the process disclosed by Yasuda et al.. However, the examiner ignores the fact that although the two secondary references (Tilman et al. and Myers) describe conditions for conducting recrystallization, these two cited references both require metal working to achieve **a reduction in thickness which exceeds 10%**. For example, Tilman et al. require a thickness reduction of about

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67% or greater (see column 1, lines 11-17 and claim 1, lines 3-4). In contrast the total thickness deformation which occurs in applicant's invention is less than 10%.

Similarly, Myers also require more than 10% reduction in thickness. In particular, the passage noted by the examiner (column 3, line 27 to column 5, line 12) requires reducing the thickness of the metal strip by passing it through successive rolls wherein each roll in succession reduces the thickness by about 25% (column 3, lines 35-40). It is further stated that the total thickness reduction is about 90% which is achieved by multiple successive reductions of about 25% each (see column 4, lines 5-7).

In view of the above it is clear that utilizing the recrystallization techniques required by the secondary references will result in thickness reductions which lie outside of the thickness reduction recited in applicant's claims. Furthermore, the admitted prior art only refers to the thickness reductions achieved during conventional perforation and expansion **without any heat treating step being performed immediately after the perforation step**. As noted above, none of the other prior art references disclose or suggest the particular heat treatment step immediately following the perforation step. In addition the deformation of less than 10% which is required by the admitted prior art will not accomplish the objectives of the other secondary references (Tilman et al. and Myers) since both of these references require deformation which is far greater than 10% in order to meet their objectives. In this regard the examiner is once again reminded that if a proposed modification which render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.

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The only remaining rejection is the rejection of claims 1-16 and 18-35 under 35 U.S.C. § 103 as being unpatentable over Abdel-Reihim in view of Tilman et al. or Myers and further in view of the teaching of the above-noted acknowledged prior art admission. Applicant has carefully considered this rejection but it is most respectfully traversed in view of the below discussion.

In rejecting the claims the examiner notes that the features relied upon in the rejection can be found in the abstract of the Abdel-Reihim et al. reference. However, the examiner acknowledges that Abdel-Reihim et al. do not disclose the recrystallization conditions and special grain boundary percentage. The examiner turns to the secondary references for this aspect of the invention.

Applicant submits that none of the secondary references, either alone or in combination with each other, disclose the specific recrystallization conditions and special grain boundary percentage. In fact, none of the secondary references disclosed or even mention the concept of the special grain boundary characteristic which applicant achieves in his invention. In addition, as discussed above, Tilman et al. and Myers require a thickness reduction which exceeds applicant's requirement for less than 10% total thickness deformation during the perforation step. Accordingly the combination of the primary reference with Tilman et al. and Myers will not result in applicant's claimed invention. Furthermore the admitted prior art which limits the deformation to less than 10%, does not utilize a subsequent annealing or heat treatment step to produce the required recrystallization for achieving the special grain boundary content. In addition, utilizing a deformation of less than 10% as set forth in the admitted prior art will result in a modification of the prior art which would render the prior art unsatisfactory for its intended purpose. In this regard it is to be noted once

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again that Tilman et al. and Myers require higher levels of deformation to achieve their objectives or purpose. As discussed above, it is well settled that if proposed modifications would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.

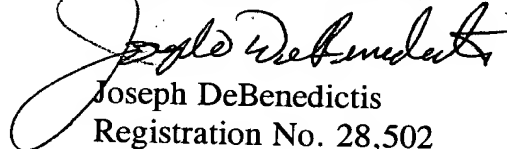
In view of the above arguments, applicant respectfully requests reconsideration and allowance of all the claims which are currently pending in the application.

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